

UTILITY
PATENT APPLICATION
TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR
1.53(b))

Attorney Docket No.

P99,2717

First Named Inventor or Application Identifier

Andres Sommer

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ADDRESS TO: Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☒ Specification [Total Pages 11]
2. ☒ Drawing(s) (35USC 113) [Total Pages 2]
3. ☒ Declaration and Power of Attorney [Total Pages 2]
 - a. ☒ Newly executed declaration (Original copy)
 - b. ☐ Copy from prior application (37CFR 1.63(d))
(for continuation/divisional with Box 14 completed)
 - i. ☐ [Note Box 4 Below]
DELETION OF INVENTOR(S)
Signed statement attached deleting
inventor(s) named in the prior application,
see 37 CFR 1.63(d)(2) and 1.33(b).
4. ☐ Incorporation By Reference (usable if Box 3b is checked)
The entire disclosure of the prior application, from which a
copy of the oath or declaration is supplied under Box 3b,
is considered as being part of the disclosure of the
accompanying application and is hereby incorporated by
reference therein.

ACCOMPANYING APPLICATION PARTS

5. ☒ Assignment Papers (cover sheet & documentation)
Siemens Aktiengesellschaft
6. ☐ Letter under 37 CFR 1.41(c).
7. ☐ English Translation Document (if applicable)
8. ☐ Information Disclosure Statement (IDS)/PTO-1449 ☐ Copies of IDS Citations
9. ☐ Preliminary Amendment
10. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)
11. ☐ Small Entity ☐ Statement filed in prior application,
Statement(s) Status still proper and desired
12. ☒ Certified Copy of Priority Document(s) German
Application No. 199 08 494.7 filed February 26, 1999
13. ☐ Other:

14. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) ☐ of prior application No: 1

CLAIMS AS FILED

(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) BASIC FEE \$690.00
TOTAL CLAIMS 20	7			
INDEPENDENT CLAIMS 3	1			
ANY MULTIPLE DEPENDENT CLAIMS? (YES (X) NO)				
			TOTAL FILING FEE ->	\$690.00

☒ The Commissioner is hereby authorized to charge any additional fees which may be required in connection with this application, or credit any overpayment to ACCOUNT NO. 08-2290. A duplicate copy of this sheet is enclosed.

☒ A check in the amount of \$ 690.00 to cover the filing fee is enclosed.

15. CORRESPONDENCE ADDRESS

HILL & SIMPSON
A Professional Corporation
233 South Wacker Drive - 85th Floor Sears Tower
Chicago, Illinois 60606
Telephone (312) 876-0200 - Fax (312) 876-0898

SIGNATURE: R. Ward
491/899:1190
U-11

DATE: January 31, 2000

SPECIFICATION

TITLE

"COMPUTED TOMOGRAPHY APPARATUS"

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is directed to a computed tomography apparatus of the type having a gantry with a measuring opening, an X-ray source movable around the measuring opening for irradiating an examination area from different directions, a detector for registering corresponding projections, and at least one support table having a support plate, with the gantry being movably fashioned such that it can be moved into at least one use position.

Description of the Prior Art

United States Patent No. 5,448,607 and United States Patent No. 5,499,415 describe computed tomography apparatuses of the above general type.

It has been determined that approximately 50 through 60% of the time spent at computed tomography apparatuses in hospitals at the moment is occupied by positioning the patient on the support table in a way appropriate for the respective examination. During that time, the computed tomography apparatus cannot be used for examinations, since the service personnel are occupied with waiting while the patient climbs onto the support table, which is firmly attached to the computed tomography apparatus and which is technically complicated, and the service personnel are then occupied with positioning the patient thereon.

In order to reduce such apparatus downtime it is known from the aforementioned patents to fashion the gantry and the support table such that they can be moved. Such a movable table, as the table of a conventional computed tomography apparatus, is provided with a longitudinally displaceable support plate that is attached to the movable pedestal of the support table. Additionally, a coupling mechanism, which enables a rigid connection of the support table with the gantry, is provided. This enables patients to be prepared without blocking use of the computed tomography apparatus but the overall technical outlay that is required is not less, and is perhaps greater, compared to a conventional computed tomography apparatus.

The same is true of the computed tomography apparatus known from German OS 195 05 276, which has a gantry, which is movable relative to a stationary support table and which, docked to the patient support table, can be adjusted relative to the support table by a drive unit.

SUMMARY OF THE INVENTION

An object of the present invention is to provide a computed tomography apparatus of the type described above which allows a technically simple way for preparing patients on the support table for examinations without blocking the computed tomography apparatus.

This object is achieved in accordance with the invention in a computed tomography apparatus wherein the gantry can be moved independently of the support table and that is preferably motor-driven, and wherein the support table, has a support plate with one end non-displaceably mounted cantilevered to a carrier, wherein an adjustment of the support plate is not required in order to place it into the measuring

opening of the gantry. As a result, the gantry can be moved toward the other end of the support plate without any problems so that the support plate extends through the measuring opening of the gantry in the use position, and therefore the support table need not have a displaceable support plate nor a driving device for the support plate. Thus, the support table can be constructed extremely simply, so that a number of support tables can be economically provided, enabling the preparation of a number of patients at the same time for an examination at the computed tomography apparatus.

In an embodiment of the invention, the carrier have a floor stand or a ceiling stand, but a floor stand is advantageous when the support table is movably fashioned according to a version of the invention, since, differing from the use of a ceiling stand, rails are then not necessary. The utilization of a ceiling stand, however, has the advantage that it usually represents a less disturbing impediment to personnel movement, and the placement of auxiliary devices, compared to a floor stand.

In another embodiment of the invention, the support table can be positioned relative to the gantry such that straight lines, generated by parallel projections of the longitudinal axis of the support plate and the system axis into a horizontal plane, for example, the floor of the examination room, are crossed (intersect) when the gantry is situated in a use position. In a simple way, it is therefore possible to achieve the equivalent of swivelling of a conventional support table without mechanical measures. Only the diameter of the measuring opening and the width of the support plate must be selected corresponding to a maximally desired extent of the swivel.

In a preferred embodiment of the invention the gantry can be moved in the direction of the system axis for volume scanning of the examination area with the

support plate situated in the measuring opening. Therefore, it is possible to undertake spiral scans or sequence scans.

The movability of the gantry can be achieved in a particularly simple and precise way when it is movable on rails according to a version of the invention.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a side view of an inventive computed tomography apparatus.

Figure 2 is a view from above of a further embodiment of an inventive computed tomography apparatus.

Figure 3 is a side view showing a particular operational condition of the computed tomography apparatus according to Figure 2.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 shows a computed tomography apparatus having a gantry 1 with a measuring opening 2, which is surrounded by a rotary ring 3 on which an x-ray source 4 and a curved detector 5 are mounted. The x-ray source 4 emits a fan-shaped x-ray bundle (not shown) that is incident on the detector 5, which is curved around the focus of the x-ray source 4 and which is formed by a series of individual detectors.

By means of rollers 6 on parallel rails (only one is visible in Figure 1), the gantry 1 is movable in the direction of the double arrow z by a motor drive 8 (shown in broken lines in Figure 1). This movement is independent of a support table 9 on which a support plate 10 for a patient to be examined is situated.

For producing computed tomographic images, the gantry 1 with the x-ray source 4 and the detector 5 is moved from a standby position (not shown) relative to the support table 9, into a use position in which the support plate 10 of the support table 9

extends through the measuring opening 2 of the gantry 1, as is necessary for producing computed tomographic images of the patient. For purposes of producing an image of a planar slice of the patient, the rotary ring 3 with the x-ray source 4 and the detector 5 is rotated around the system axis Z for the acquisition of a number of projection datasets with the x-ray source 4 irradiating the patient on the support plate 10 respectively from different directions. These projection datasets serve the purpose of reconstructing a tomogram in a known manner. During this data acquisition the gantry 1 remains stationary on the rails 7 and the support table 9 remains stationary on the wheels 11.

The gantry 1 can be moved into the use position, since the support plate 10 of the support table 9 has one end attached cantilevered to a carrier, which is fashioned as a floor stand 12 that is movable on the wheels 11. Due the movability of the gantry 1 on the rails 7 and due the movability of the support table 9 on the wheels 11 of its floor stand 12, longitudinal displaceability of the support plate 10 relative to the floor stand 12 is not necessary, thus allowing the support plate 10 to be attached to the floor stand 12 in a non-displaceable manner.

Therefore, the support table 10 is not of a type as is conventional in computed tomography, with a support plate that can be displaced relative to a carrier. Instead, the support table 10 of the inventive apparatus has a significantly simpler structure which, due to the cantilevered support plate 10, enables the placement of the gantry 1 into a use position corresponding to the type of examination so that the support plate 10 extends through the measuring opening 3. For this purpose, it is only necessary to

place the support table 9 coarsely in such a position, so that an area of the patient that is to be examined can be reached by adjusting the gantry 1 on the rails 7.

Due to the motor-driven adjustability of the gantry 1 in the direction of the system axis Z, there is also the possibility of undertaking volume scans of a relevant examination area of the patient. In a known manner, such volume scans can be carried out as sequence scans or as spiral scans. In the case of sequence scanning, a stepped displacement of the gantry 1 in the direction of the system axis Z ensues after scanning of a planar slice of the examination area until the relevant examination area is scanned in the form of a sequence of planar slices. In the case of a spiral scan, the rotary ring 3 rotates continuously, while the gantry 1 is continuously moved in the direction of the system axis Z, whereby the rotating speed of the rotary ring 3 and the translational speed of the gantry 1, in the direction of the system axis Z, have a fixed ratio to one another corresponding to the desired pitch of the spiral scan.

The computed tomography apparatus shown in Figure 2 differs from the embodiment of Figure 1 in that the support table 13 has a ceiling stand 13 as a carrier for the support plate 17. The ceiling stand 13 can be moved by rollers 14 always two parallel ceiling rails 15 (only one is visible in Figure 2).

Analogously to the previously described exemplary embodiment, the support plate 17 of the support table 13 in the embodiment of Figure 2 is attached to the ceiling stand 14 in a non-displaceable manner, however, there is the possibility to pivot the bearing plate 17 around the center axis 18 of the ceiling stand 14 in the direction of the curved double arrow α .

As shown in Figure 3, it is therefore possible to conduct examinations with swivel, wherein the support table 13 and the gantry 1 are positioned relative to one another such that the straight lines cross (intersect), which are respectively generated by parallel projections of the longitudinal axis 19 of the support plate 17 and the system axis in a horizontal plane, for example, on the floor of the examination room when the gantry 1 (as shown in Figure 3) is in a use position in which the support plate 17 extends through the measuring opening 3 of the gantry 1.

In the exemplary embodiment according to Figure 1, the support table 9 and the gantry 1 can be positioned relative to one another such that examinations with swivel are possible.

The fashioning of the support tables 9 and 13 in the described exemplary embodiments is only an example. The important feature of the inventive apparatus is that the support table 9 or 13 is constructed such that the gantry 1 can be moved into a use position in which the plate 10 or 17 extends through the measuring opening of the gantry 1.

In the exemplary embodiments, only one support table 9 or 13 is shown. In the context of the invention, however, a number of support tables can be provided in order to be able to prepare a number of patients at the same time in the interest of an optimal use of the computed tomography apparatus, so that examinations of the individual patients can ensue immediately in succession.

The invention can be used in computed tomography apparatuses with a single-line detector, a multiple-line detector or a matrix-like detector.

The computed tomography apparatuses according to the described exemplary embodiments are computed tomography apparatuses of the third generation, however, the invention can be used with computed tomography apparatuses of the fourth generation. as well.

Although modifications and changes may be suggested by those skilled in the art, it is the intention of the inventor to embody within the patent warranted hereon all changes and modifications as reasonably and properly come within the scope of his contribution to the art.

I CLAIM AS MY INVENTION:

1. A computed tomography apparatus comprising:
 - a gantry having a measuring opening;
 - an x-ray source mounted in said gantry having a focus from which radiation is emitted, at least said focus rotating around said measuring opening for irradiating an examination subject from different directions;
 - a detector disposed in said opening for obtaining projection datasets corresponding to radiation incident on said detector as said focus rotates around said measuring opening;
 - a support table having a support plate, adapted to receive an examination subject thereon, and a carrier, said support plate being non-displaceably mounted cantilevered to said carrier; and
 - a mechanism for moving said gantry independently of said support table, including movement of said gantry into a use position wherein said support plate extends through said measuring opening.
2. A computed tomography apparatus as claimed in claim 1 wherein said carrier comprises a floor stand.
3. A computed tomography apparatus as claimed in claim 1 wherein said carrier comprises a ceiling stand.

4. A computed tomography apparatus as claimed in claim 1 wherein said support table is movable.

5. A computed tomography apparatus as claimed in claim 1 wherein said support table has a longitudinal axis and wherein said gantry has a system axis, and wherein said support table is positionable relative to said gantry so that said longitudinal axis and said system axis, when projected into a horizontal plane, intersect when said gantry is in said use position.

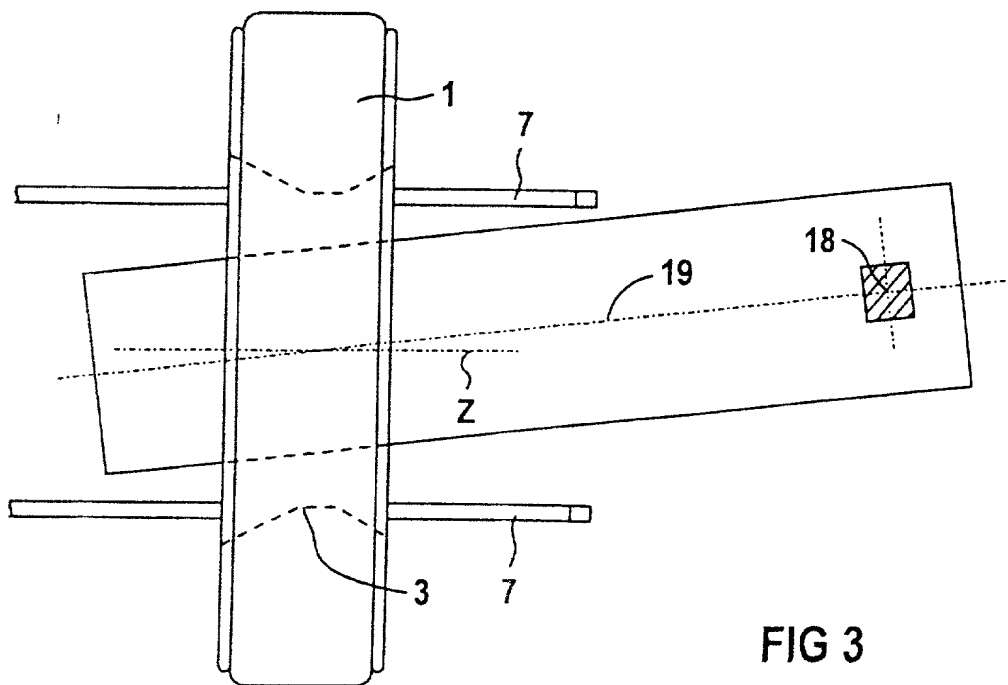
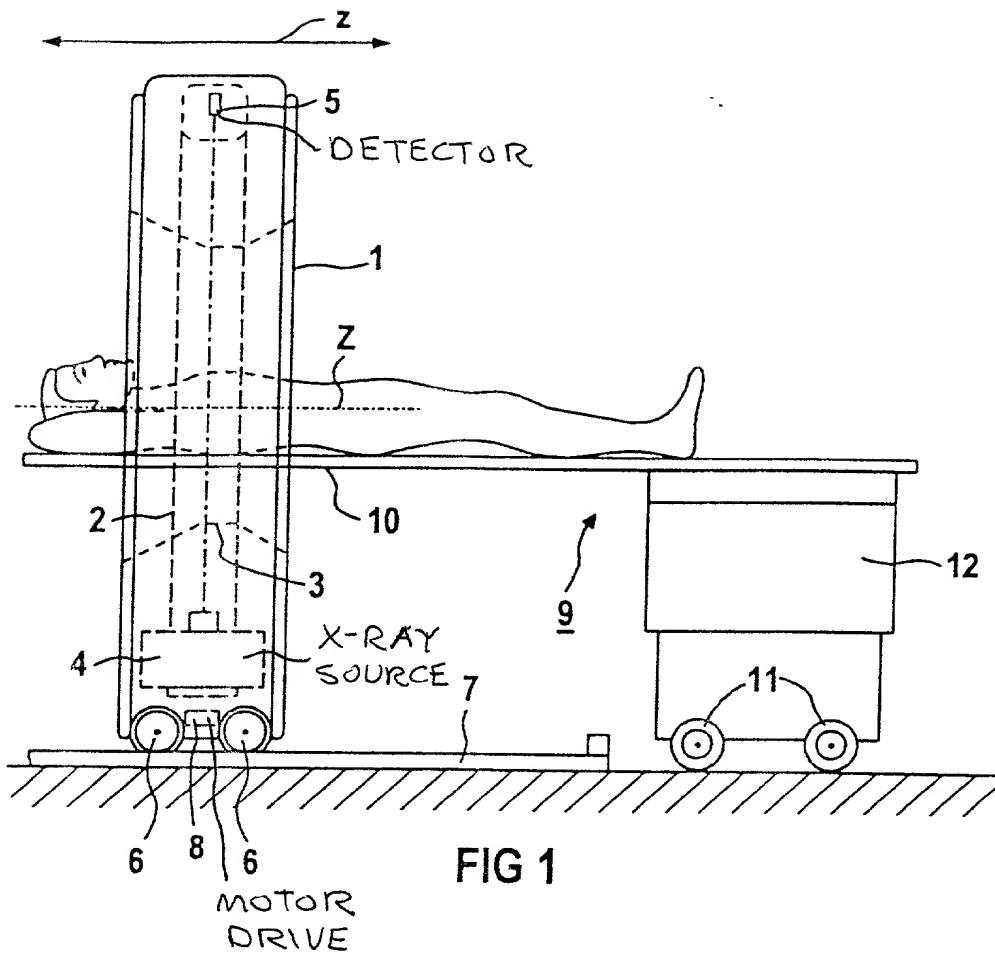
6. A computed tomography apparatus as claimed in claim 1 wherein said gantry has a system axis and further comprising a motor drive for moving said gantry along said system axis to allow scanning of a volume of an examination subject adapted to be received on said support plate in said measuring opening.

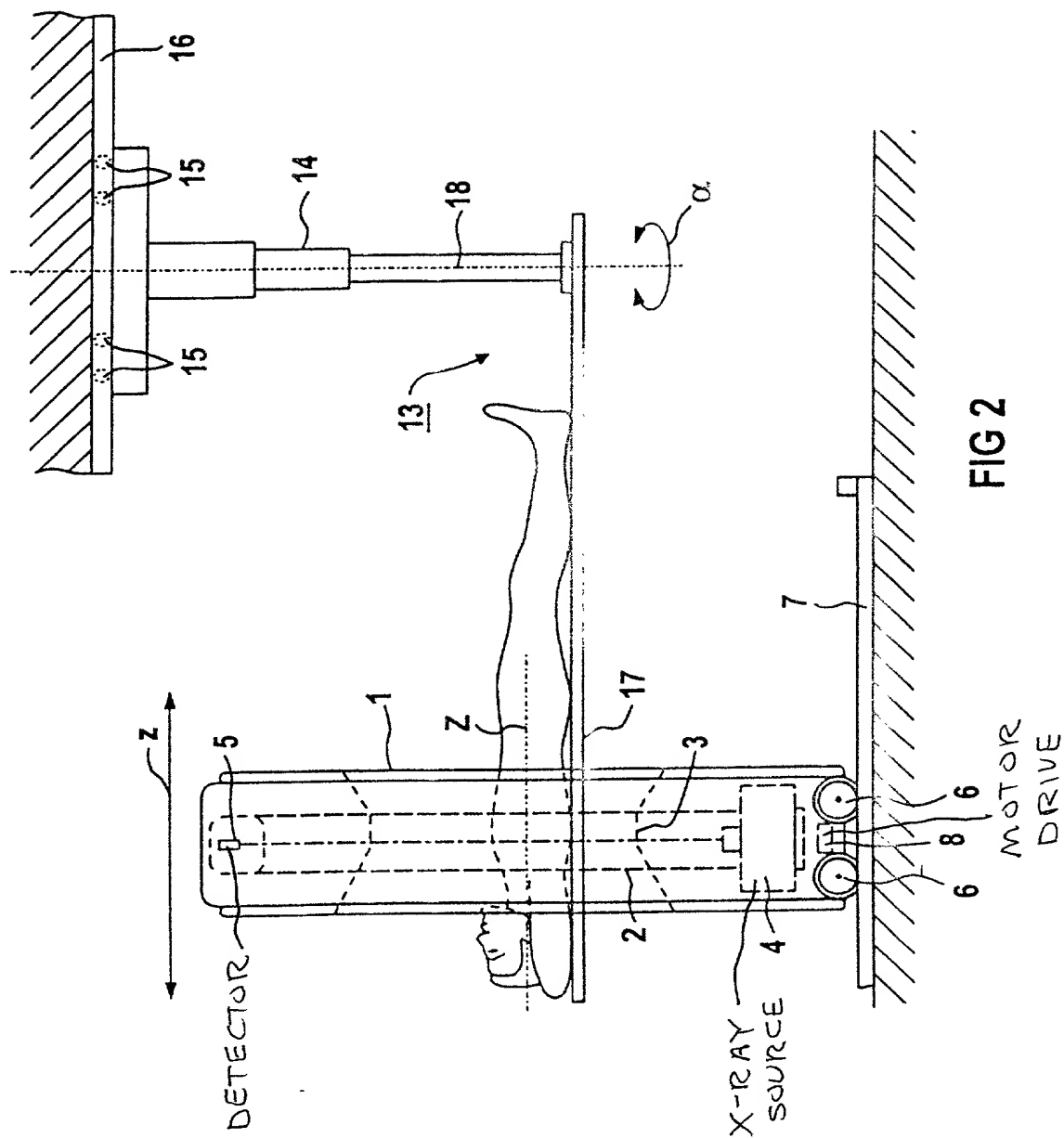
7. A computed tomography apparatus as claimed in claim 1 wherein said mechanism comprises rails along which said gantry is movable.

ABSTRACT OF THE DISCLOSURE

A computed tomography apparatus has a gantry with a measuring opening, with an x-ray source movable around the measuring opening for irradiating an examination area from different directions, a detector for registering corresponding sets of projection data, and at least one support table having a support plate. The gantry can be moved into a use position independently of the support table and the support table is fashioned such that the support plate extends through the measuring opening when the gantry assumes a use position.

1/2





DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

"COMPUTER TOMOGRAPHY APPARATUS"

Case No. P99,2717, the specification of which

(check one) ☒ is attached hereto.
☐ was filed on _____, as
Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent Office all information which is known to me to be material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, 1.56(a).¹

I do not know and do not believe this invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and I believe that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application, and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by me or my legal representatives or assigns, except as identified below:

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below

Prior Foreign Application(s)

Number

Country

Date

199 08 494.7

Germany

February 26, 1999

and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the above listed application on which priority is claimed:

Prior Foreign Application(s)

Number

Country

Date

¹ (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a *prima facie* case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office, or

(ii) Asserting an argument of patentability.

A *prima facie* case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

If no priority is claimed, I have identified all foreign patent applications filed prior to this application:

Prior Foreign Application(s)

Number

Country

Date

And I hereby appoint Messrs. John D. Simpson (Registration No. 19,842), Dennis A. Gross (24,410), Robert M. Barrett, (30,142), Steven H. Noll (28,982), Kevin W. Gynn (29,927), Robert M. Ward (26,517), Brett A. Valiquet (27,841), Edward A. Lehman (22,312), David R. Metzger (32,919), Todd S. Parkhurst (26,517), James D. Hobart (24,149), Melvin A. Robinson (31,870), Joseph P. Reagen (35,322), Michael R. Hull (35,902), Michael S. Leonard (37,557), William E. Vaughan (39,056) and Lewis T. Steadman (17,074), all members of the firm of Hill & Simpson, A Professional Corporation

Telephone: 312/876-0200 Ext. 3491

my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and direct that all correspondence be forwarded to:

Hill & Simpson
A Professional Corporation
85th Floor Sears Tower, Chicago, Illinois 60606

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor ANDRES SOMMER

Inventor's signature [Signature] Date 01/26/2000

Residence 90765 Fuerth, Germany

Citizenship Germany

Post Office Address Ronhofer Weg 15

90765 Fuerth, Germany

Full name of second joint inventor,
(if any) _____

Inventor's signature _____ Date _____

Residence _____

Citizenship _____

Post Office Address _____

Full name of third joint inventor,
(if any) _____

Inventor's signature _____ Date _____

Residence _____

Citizenship _____

Post Office Address _____